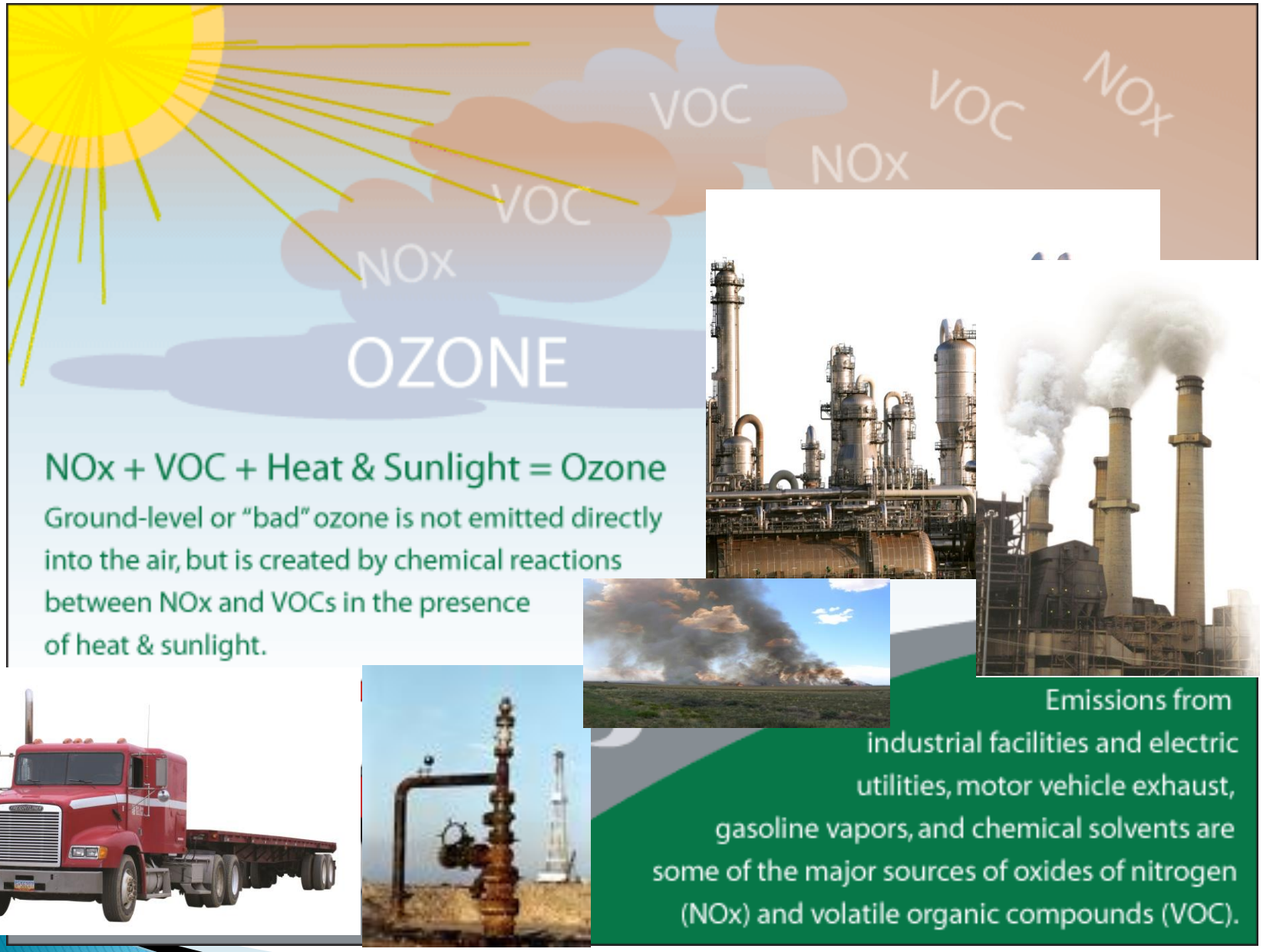
Ozone in the Four Corners and the Uintah Basin

Four Corners Air Quality Group Update Meeting
September 9, 2013
Durango, CO

Presentation Overview

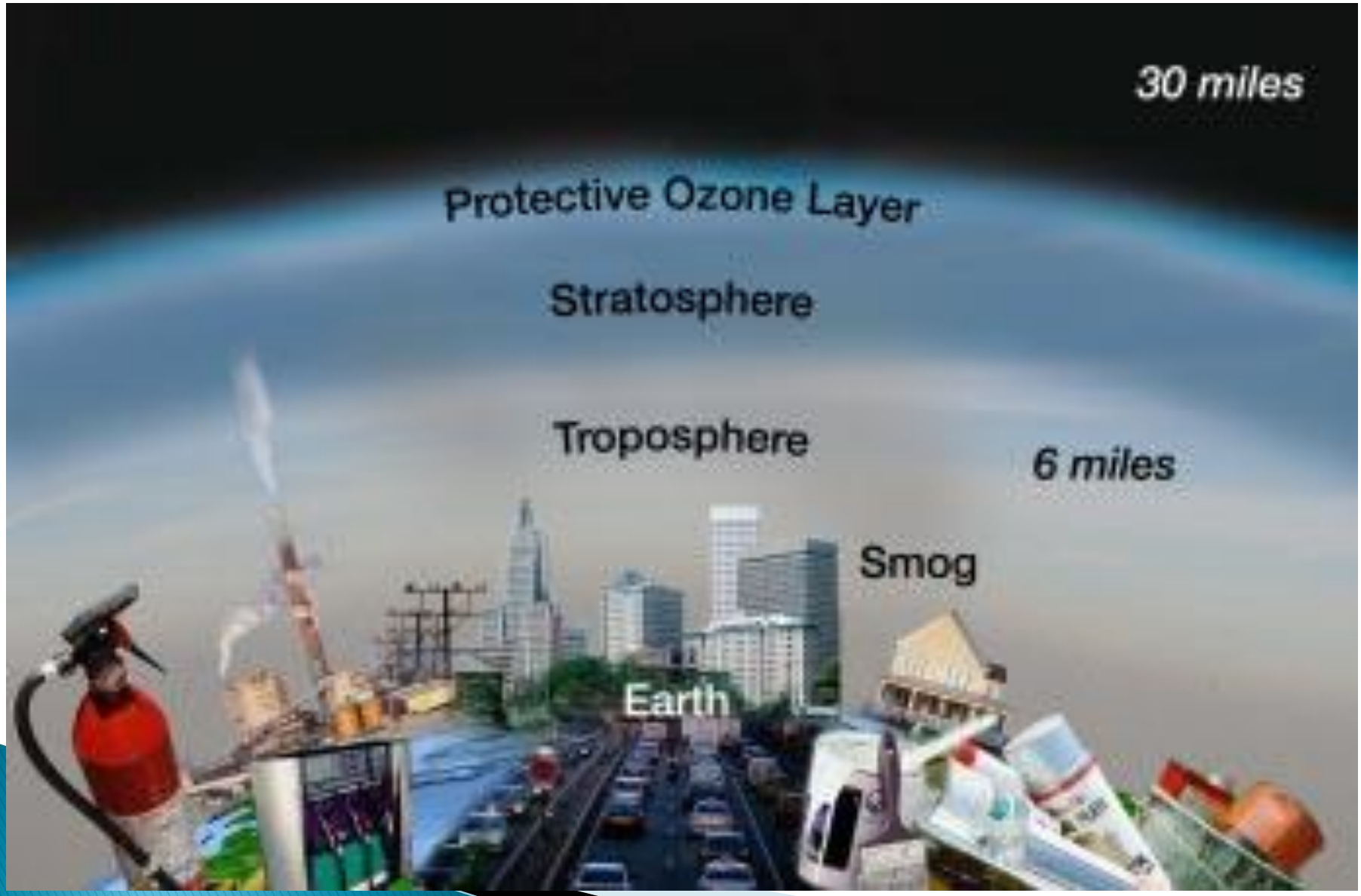
- What is Ozone?
- Ozone Levels in the Four Corners
- EPA's reconsideration of the Standard
- Uinta Basin Ozone Monitoring Project


VOC
VOC
NOx
NOx
VOC
NOx
OZONE
NOx + VOC + Heat & Sunlight = Ozone
Ground-level or "bad" ozone is not emitted directly into the air, but is created by chemical reactions between NOx and VOCs in the presence of heat & sunlight.
Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of oxides of nitrogen (NOx) and volatile organic compounds (VOC).

What is Ground Level Ozone (O3)?

- A gas composed of 3 oxygen atoms.
- Created by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of strong sunlight.
- Because ozone is formed through a complex and ongoing chemical reaction, ozone concentrations in a region can vary considerably
  - Often the highest ozone concentrations occur some distance from the emission sources

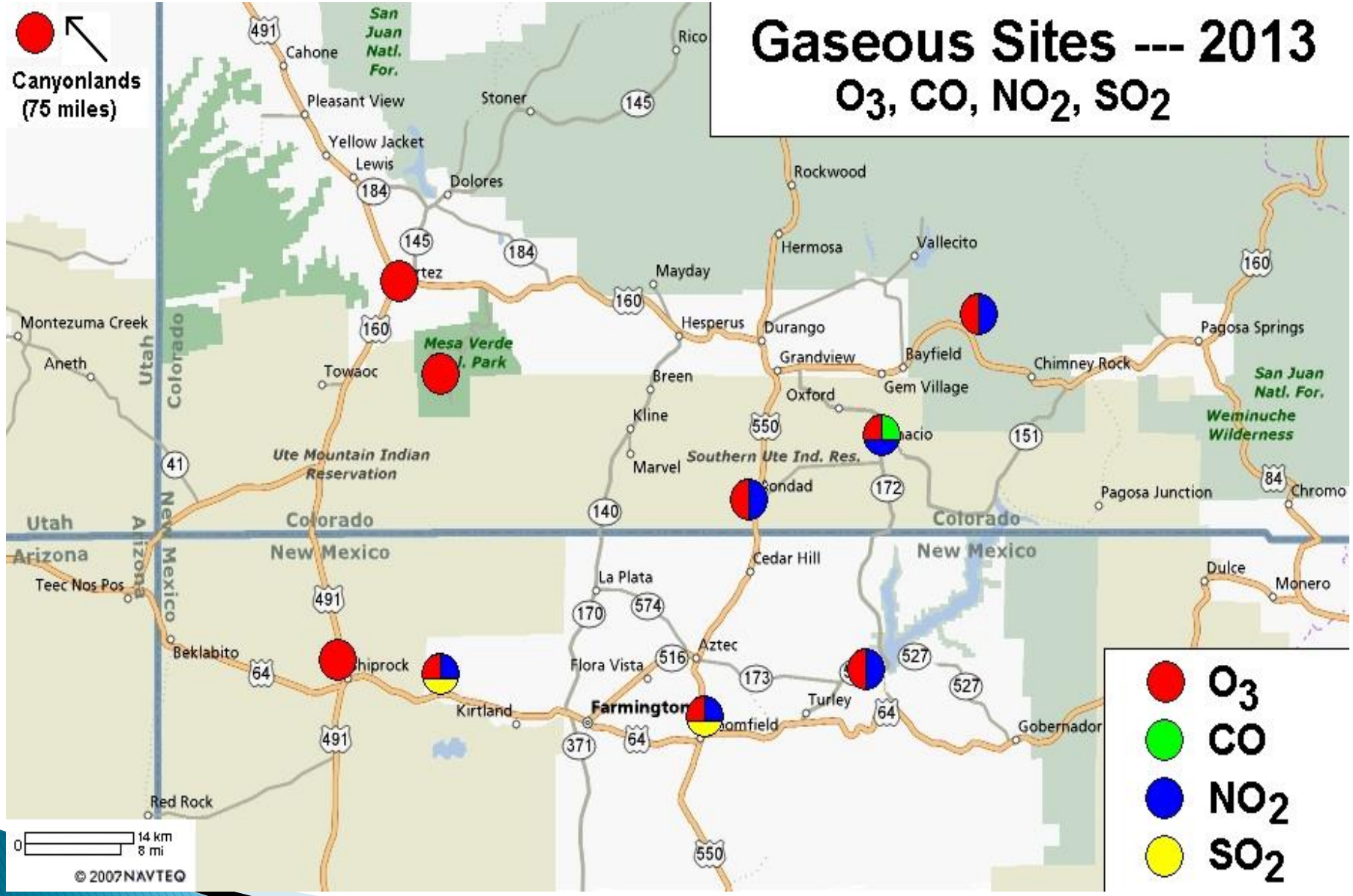
Good Up High, Bad Near By



Health Concerns from Elevated Ground Level Ozone

- Chest pain, coughing, throat irritation, and congestion
- Bronchitis, emphysema, and asthma.
- Reduced lung function and inflammation of the lung linings.
- Permanently scarring of lung tissue.
- Damage to plants and crops.

Ozone Levels in the Four Corners


Gaseous Sites --- 2013
O_3, CO, NO_2, SO_2
Canyonlands
(75 miles)
O_3
CO
NO_2
SO_2
Cahone
Pleasant View
Yellow Jacket
Lewis
Stoner
Rico
Dolores
Rockwood
Hermosa
Vallecito
Mayday
Hesperus
Durango
Grandview
Bayfield
Chimney Rock
Pagosa Springs
Gem Village
Oxford
Breen
Kline
Marvel
Towaoc
Montezuma Creek
Aneth
Utah
Colorado
Arizona
New Mexico
Mesa Verde
Ute Mountain Indian Reservation
Southern Ute Ind. Res.
San Juan Natl. For.
Weminuche Wilderness
Pagosa Junction
Chromo
Dulce
Monero
Cedar Hill
La Plata
Aztec
Flora Vista
Farmington
Kirtland
Turley
Gobernador
Beklabito
Teec Nos Pos
Red Rock
0
14 km
8 mi
© 2007 NAVTEQ

Southwest Colorado Monitoring Stations (Ozone)

UTE 3

UTE 1

NPS – Mesa Verde

NFS – Shamrock

Northwest NM Monitoring Stations

Substation

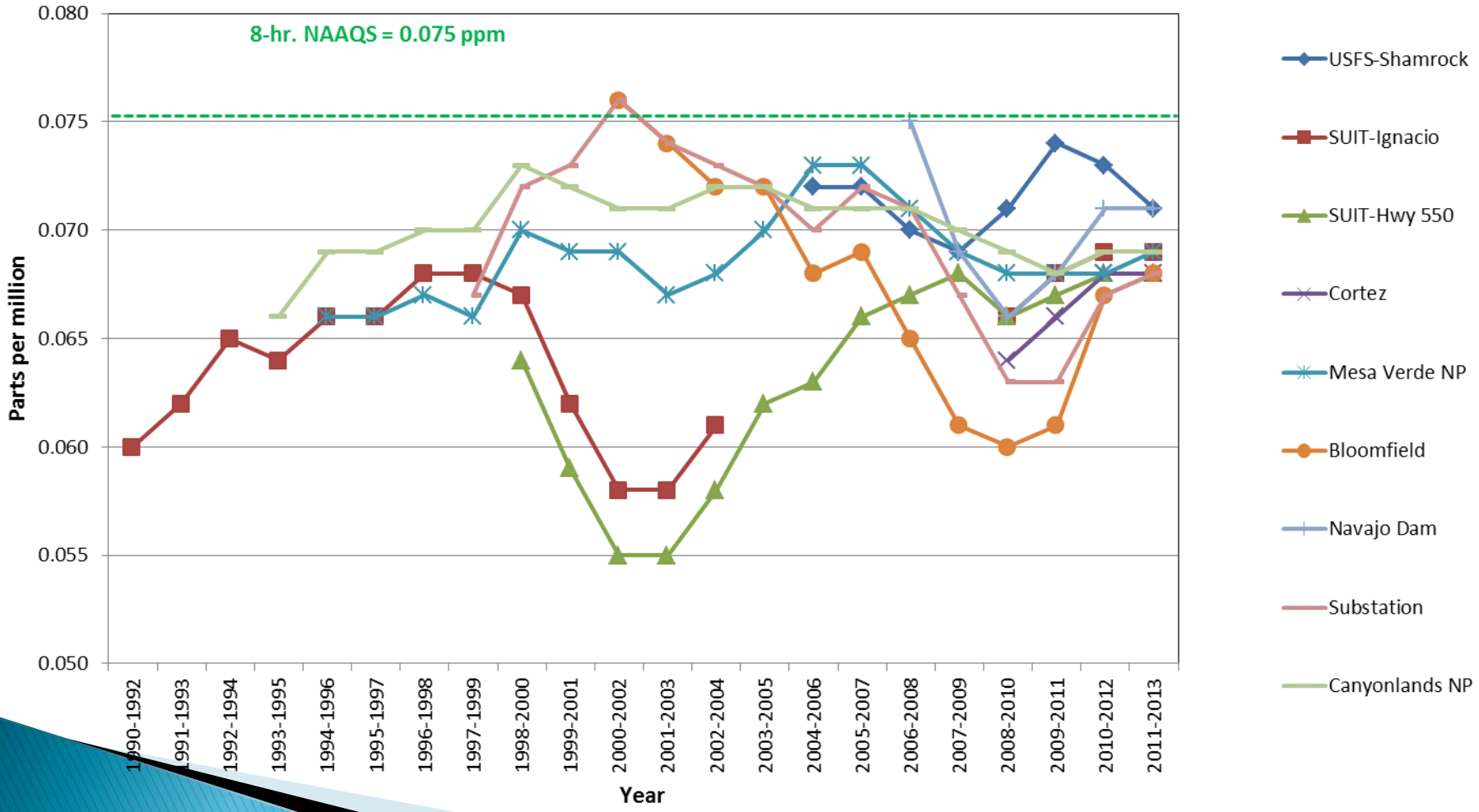
Bloomfield

Navajo Lake

Gaseous Monitors
Ozone, Nitrogen Dioxide, and Sulfur Dioxide

8-Hour Ozone --- 3-year Avg. of 4th Max.

Four Corners area



2013 thru 4/30
or 7/31

Status of the ozone standard reconsideration

- In July, 2013 the U.S. Court of Appeals in D.C. considered several petitions challenging EPA's most recent revisions to the primary (health) and secondary (environmental) NAAQS for ozone. The Court denied all the petitions, except with respect to the secondary ozone standard, which they remanded for reconsideration. This decision will be rolled into the NAAQS review for ozone.

- The Clean Air Act-mandated five-year NAAQS review of the existing standard is still underway. The next step in the review is for EPA to complete the second drafts of the risk and exposure assessments and the policy assessment. EPA is working to revise the schedule for the remaining steps in the review process. EPA expects to release for CASAC and public review the second draft Risk and Exposure Assessments and the Policy Assessment in early December 2013. They have requested that the next meeting of the CASAC Ozone Review be scheduled for March 2014 to allow three months for CASAC and public review.

High Winter Ozone Levels First Observed in WY

- In February-March 2005 hourly ozone concentrations greater than 120 ppb were recorded at monitoring stations in the Upper Green River Basin, Wyoming; it happened again in 2006, 2008 and 2009.
- Conditions:
  - Strong inversion with a meteorologically stable near surface layer of air
  - Snow cover that increases radiation and strengthens the surface inversion layer
  - Emissions of VOCs and NOx, with a high VOC/NOx ratio, relative to typical summer ozone conditions

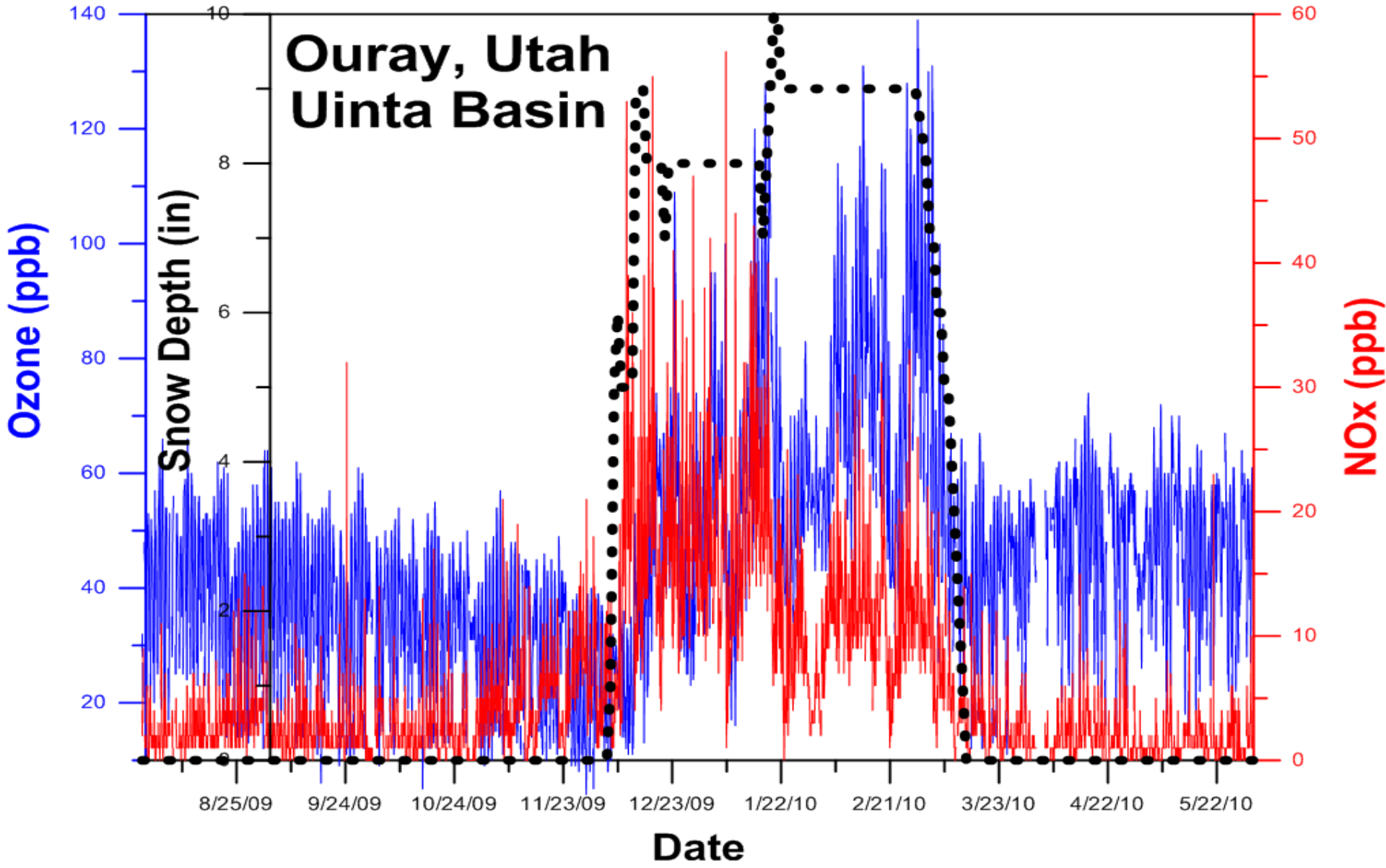
What we think happens with winter ozone formation

- High pressure sets up over the Green River Basin
- Intense low-level surface inversion forms during the night, with light/variable winds
- NO, NOx & VOCs emitted from industrial activity accumulate in the nighttime
- Background ozone is 40-50 ppb
- Fresh snow on the ground
- Next morning – clear skies with high solar radiation
- Surface inversion is not broken and winds remain light/variable
- The highly reflective snow surface causes peak mid-day photochemical rates 50% higher than in the summer
- This photochemistry happens quickly, over hours, and results in large near surface ozone concentrations to above 120 ppb.

It's happening in the Uinta Basin too

- Winter 2011 monitored ozone values as high as 146 ppb
- Same fundamental processes that cause elevated ozone in WY apply to UT, with some important differences:
  - Terrain
  - Dispersion
  - VOC and NOx emission levels
  - VOC to NOx ratios could result in differences in ozone sensitivity to VOC and NOx, and potentially different types of emissions reduction strategies.

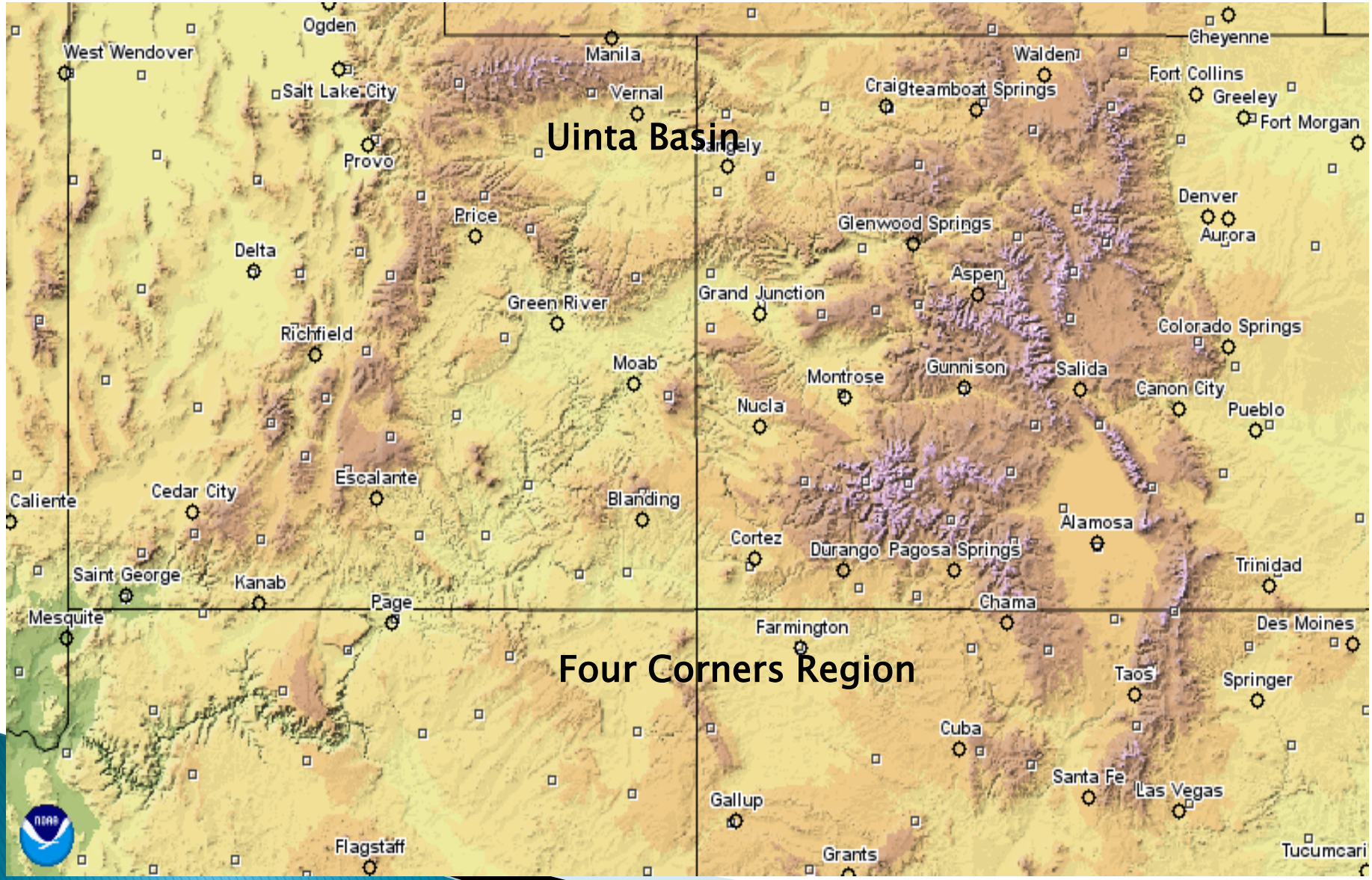
Ozone, NOx and Snow Depth: Winter 2009/10



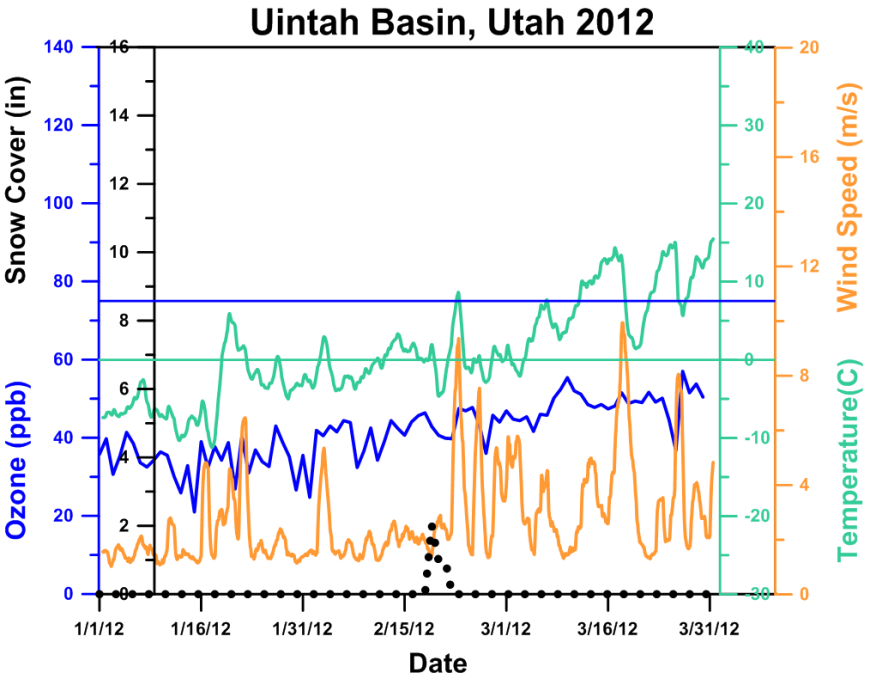
Could it Happen in the San Juan Basin?

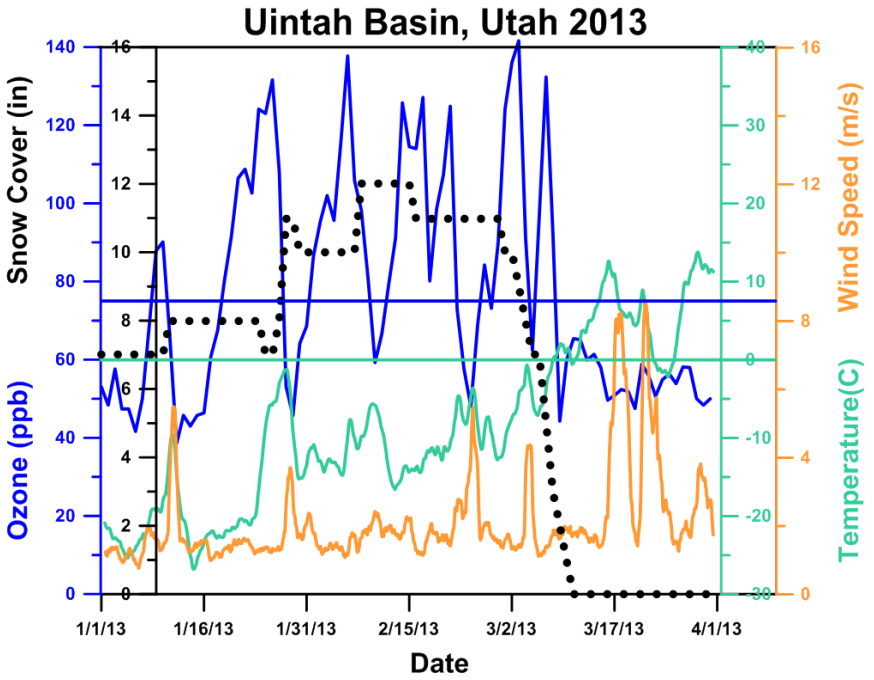
- It's shallower, wider, broader than the Upper Green River and Uinta Basins without northwest and southwest mountain ranges to create a full bowl effect; there's not a lot of snow and trapping geography
- Daytime temps above freezing most days, snow melts; in Uinta and Upper Green River Basins, snowfall stays on the ground for months (Dec. – March). If no snow in Dec. ,it tends to be a dry winter, with no winter ozone (i.e. 2012).
- Need several days in a row of strong temperature inversions, very cold air trapped over snow cover; extremely rare in the San Juan Basin. With 15 years of ozone data, we've never seen it happen there.

Uinta Basin and the Four Corners Region



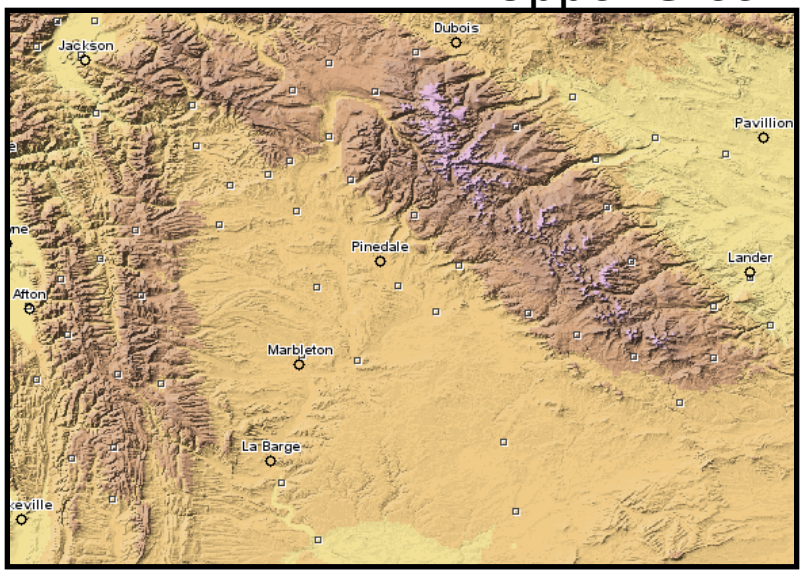
Ozone in the Uinta Basin of Utah in Winter 2012 and 2013





Topographical Comparison of the Basins

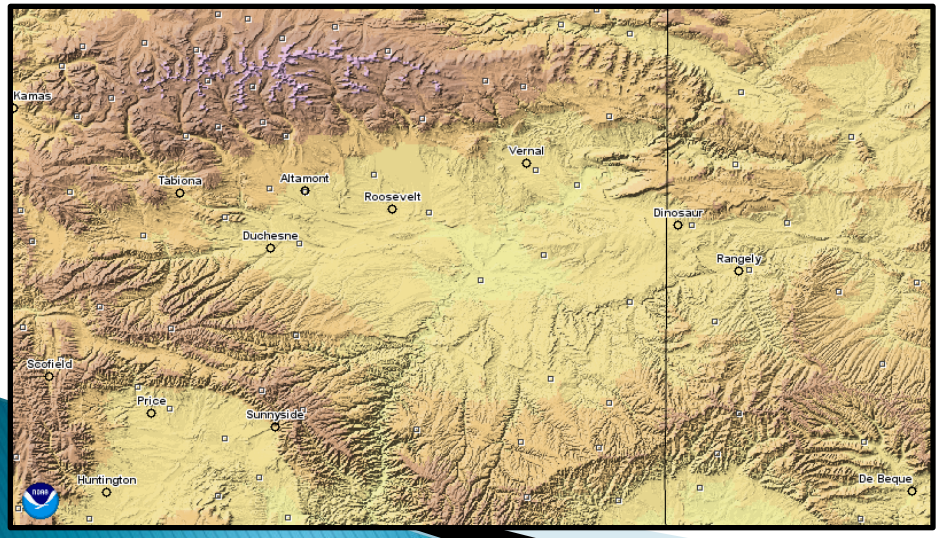
Upper Green



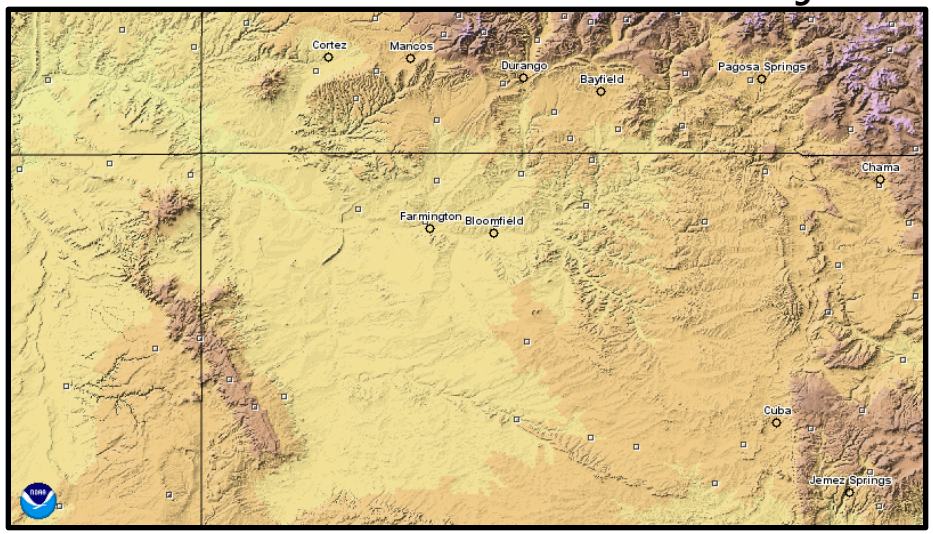
Elevation in feet

	> 13124		4922 to 6562		< 3
	11484 to 13124		3281 to 4922		Not Estimated
	9843 to 11484		1641 to 3281		
	8203 to 9843		820 to 1641		
	6562 to 8203		3 to 820		

Uinta



San Juan

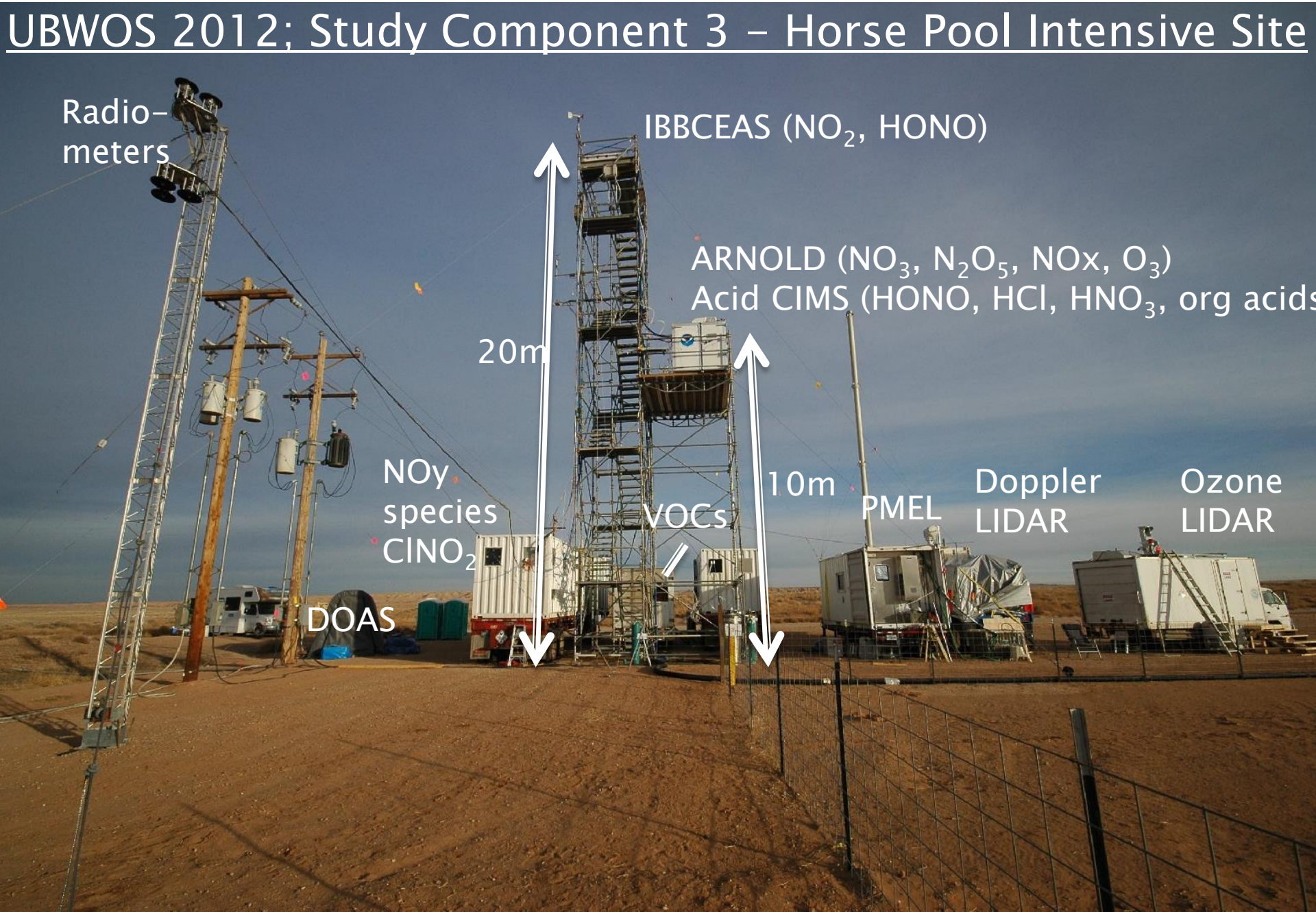


Existing Research Efforts Underway

- Several million dollars of industry and federal (more NOAA than EPA) money spent over past two years in the Uinta Basin and similarly in previous years in the Upper Green River Basin to study the winter time ozone phenomenon.

- NOAA used congressionally appropriated research dollars to focus on this issue.

UBWOS 2012; Study Component 3 – Horse Pool Intensive Site



Uintah Basin Winter Ozone Study–UBWOS 2013

Instrumentation/Measurements